

WRC-2003 Advisory Committee

IWG-4

Draft U.S. Proposal on WRC-03 Agenda Item 1.32 (Resolution 128)

United States of America

DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 1.32 *To consider technical and regulatory provisions concerning the band 37.5-43.5 GHz, in accordance with Resolutions 128 (Rev.WRC-2000) and 84 (WRC-2000);*

Background

The band 42.5 - 43.5 GHz is allocated to the Radioastronomy (RA) service on a co-primary basis, while the frequency bands immediately below 42.5 GHz are allocated to the FSS and BSS (both space-to-Earth) on a co-primary basis with each other and with terrestrial services. To protect operating RA stations, WRC-2000 established a new footnote, No. **5.551G**, which contains a provisional PFD limit - not to exceed -167 dB(W/m²) in any 1 MHz band at the site of a radio astronomy station for more than 2% of the time - on emissions produced into the 42.5 - 43.5 GHz band by non-GSO FSS or BSS systems operating in the 41.5 - 42.5 GHz band. A similar limit was imposed on emissions that GSO FSS or BSS satellites operating in the 42.0 - 42.5 GHz band may produce at the sites of RA stations operating in the 42.5 - 43.5 GHz band.

Pursuant to Resolution **128 (Rev. WRC-2000)**, the ITU-R was to conduct studies to review these provisional PFD limits; to identify technical and operational measures in the band 41.5 – 42.5 GHz, including possible mitigation techniques to protect RA operations; and to propose measures that may be implemented to reduce the susceptibility of stations in the RA to harmful interference. Issues to be addressed included:

- Adequacy of provisional limits on power flux-density (PFD) produced into the sites of radio astronomy service (RAS) stations operating in the band 42.5 - 43.5 GHz by non-GSO satellites operating in the space-to-Earth direction in the fixed-satellite service (FSS) or broadcasting-satellite service (BSS) in the band 41.5 - 42.5 GHz, and by GSO FSS or BSS satellites operating in the space-to-Earth direction in the band 42.0 - 42.5 GHz.
- Identification of technical and operational measures that FSS/BSS satellite networks can take to protect RA operations in the 42.5 - 43.5 GHz band, and of measures that may be implemented by RA service users to reduce the susceptibility of stations in the RA service to harmful interference.

The U.S. is of the view that, in order to protect radio astronomy observations in the 42.5-43.5 GHz band from out-of-band emissions from FSS and BSS satellites in the adjacent bands below 42.5 GHz and simultaneously providing the maximum opportunities for satellites, the preferred approach is to establish interference thresholds in the Radio Regulations for GSO satellites and non-GSO satellites operating in the 42-42.5 GHz band. If the thresholds would be exceeded for more than 2% of the time, the satellite administration would have to enter into bilateral arrangements with affected radio astronomy administrations to resolve the excess interference. The process for reaching such arrangements would be specified in a new Resolution XXX.

Proposals to reflect these views are provided below:

Proposals:

USA/1.32/A MOD

5.551G ~~The interference threshold in terms of the aggregate power flux-density in the 42.5-43.5 GHz band produced by all the space stations in any non-GSO FSS (space-to-Earth) or BSS (space-to-Earth) system operating in the 42.5-43.5 GHz band shall be $-137 \text{ dB (W/m}^2\text{/GHz)}$ for continuum observations in the 42.5-43.5 GHz band, and $-153 \text{ dB(W/m}^2\text{/500 kHz)}$ for spectral line observations in the 42.78-43.5 GHz band, not exceed $-167 \text{ dB (W/m}^2\text{)}$ in any 1 MHz band at the site of a radio astronomy station where single-dish radiotelescope observations are being conducted in the 42.5-43.5 GHz band, station for more than 2% of the time. The interference threshold in terms of the power flux-density in the band 42.5-43.5 GHz produced by any GSO FSS (space-to-Earth) or BSS (space-to-Earth) station operating in the band 42.0-42.5 GHz shall be $-137 \text{ dB (W/m}^2\text{/GHz)}$ for continuum observations in the 42.5-43.5 GHz band, and $-153 \text{ dB(W/m}^2\text{/500 kHz)}$ for spectral line observations in the 42.78-43.5 GHz band, at the site of a radio astronomy station where single-dish radiotelescope observations are being conducted in the 42.5-43.5 GHz band. If an administration determines that the thresholds above would be exceeded for more than 2% of the time, bilateral arrangements between affected administrations would be required. The provisions of Resolution XXX (WRC-03) shall apply not exceed $-167 \text{ dB (W/m}^2\text{)}$ in any 1 MHz band at the site of a radio astronomy station. These limits are provisional and will be reviewed in accordance with Resolution 128 (Rev.WRC-2000).~~

Reasons: Studies in the ITU-R have shown that unwanted emissions from FSS and BSS satellites operating below 42 GHz are not a potential difficulty for radio astronomy observations in the 42.5-43.5 GHz band. Studies have also shown that unwanted emissions from FSS and BSS satellites in the 42-42.5 GHz band are not a potential difficulty for VLBI observations by radio astronomy stations in the 42.5-43.5 GHz band. As for single dish telescopes conducting observations on the spectral lines mentioned in Recommendation ITU-R RA.314-8, there is the potential for interference from FSS and BSS satellites operating in the 42-42.5 GHz band. In the latter cases, however, the number of single-dish radiotelescope stations operating around the world is small enough, and the characteristics of the FSS and BSS downlink transmissions are such, that it is preferable to manage such potential interference cases through bilateral arrangements conducted pursuant to a process that is established in new Resolution XXX (see proposal USA/1.32/B below).

RESOLUTION XXX (WRC-03)

Process for assuring the protection of single-dish radiotelescopes in the radio astronomy service conducting spectral line and continuum observations within the 42.5-43.5 GHz band

The World Radiocommunication Conference (Caracas, 2003),

considering

- a) that there are primary allocations to the fixed-satellite service (FSS) (space-to-Earth) and to the broadcasting-satellite service (BSS) in the 40.5-42.5 GHz band;
- b) that because propagation impairments in the 40 GHz band are severe in bad weather, most satellite systems, in order to achieve their desired link availability and high data rates, propose to operate with high gain satellite antennas (the 3 dB beamwidths of the 40 GHz transmit and the receive antennas are in a range from 0.3° to 0.65° for GSO satellites and in a range of 0.6° to 1.8° for non-GSO satellites);
- c) that there are limits on the power flux-density (pfd) produced by FSS and BSS stations and systems in the 40.5-42.5 GHz band, with the most restrictive limits on pfd being found in the 42-42.5 GHz band, and that satellite systems in this frequency range would operate at clear-sky levels significantly lower than the pfd limits for all but very short periods of time during fading conditions;
- d) that due to satellite weight and power constraints, the area covered by the beams active at any instant in all proposed FSS and BSS systems that plan to operate in the band 40.5-42.5 GHz will be very small, typically representing less than 5% of the satellite field of view;
- e) that the FSS/BSS band at 40.5-42.5 GHz is adjacent to the band 42.5-43.5 GHz which is allocated, *inter alia*, to the radio astronomy service (RAS);
- f) that radio astronomy stations in the band 42.5-43.5 GHz (including both single dish radiotelescopes and very long baseline interferometry (VLBI) facilities) are used to conduct continuum and spectral line observations using one of approximately 30 sites located around the world;
- g) that the threshold level of detrimental interference to the RAS in the 42.5-43.5 GHz band is -153 dB (W/m²/500 kHz) for spectral line observations, -137 dB (W/m²/GHz) for continuum observations, and -116 dB (W/m²/500 kHz) for VLBI RAS stations;
- h) that results of studies indicate that the unwanted emission levels of GSO FSS and BSS systems operating in the 42.0-42.5 GHz band, and of non-GSO FSS and BSS systems operating in the 41.5-42.5 GHz band, meet the detrimental interference threshold for VLBI RAS stations operating in the 42.5-43.5 GHz band;
- j) that unless technical or operational measures are taken, the detrimental interference thresholds for a single dish radiotelescope, for continuum observations and for spectral line

observations, may not be met by unwanted emissions from a GSO FSS or BSS satellite or by unwanted emissions from a non-GSO FSS or BSS system in the 42-42.5 GHz band;

k) that because there are relatively few RAS sites operating with single dish telescopes in the 42.5-43.5 GHz band, it may be feasible to employ technical or operational measures, including but not limited to such interference mitigation techniques as geographical isolation, time sharing, better RAS antenna roll-off, etc., in order to reduce the potential for detrimental interference to the RAS receiver sites operating in this band;

l) that, taking into account the above *considerings*, it is feasible to rely on arrangements between concerned FSS/BSS and RAS administrations to ensure that the unwanted emissions for FSS and BSS satellites and systems at 42-42.5 GHz do not cause detrimental interference to RAS stations conducting continuum and spectral line observations within the 42.5-43.5 GHz band;

recognizing

a) that WRC-2000 established provisional power flux-density limits for out-of-band emissions from BSS and FSS stations in accordance with No. **5.551G**,

b) that WRC-2000 resolved that the provisional power flux-density limits in No. **5.551G** shall be applied to BSS and FSS stations for which complete coordination (GSO) or notification (non-GSO) information, as appropriate, has been received by the Bureau after the end of WRC-2000 and before the end of WRC-03;

c) that because the current protection criteria given in No. **5.551G** do not take into account the reference bandwidth and the type of observations being conducted at the radio astronomy station, adjustments regarding both of these criteria and the associated percentage of time that unwanted satellite emissions may exceed the criteria have been made by this Conference to No. **5.551G**,

d) that the flexibility of satellite networks and systems to accommodate changes in frequency plans and beam patterns diminishes as progress on implementation of the networks and systems advances, with operational or near operational networks and systems having very limited, if any, flexibility to accommodate such changes,

resolves

1 that if the unwanted emission level produced by a GSO FSS or BSS satellite or by a non-GSO FSS or BSS system operating in the band 42-42.5 GHz for more than 2% of the time would exceed the applicable interference threshold from No. **5.551G** at the site of a RAS station where single-dish telescope observations are being conducted, administrations operating such satellites and systems shall enter into discussions with the administration operating the affected RAS station to determine steps that can be taken to keep the unwanted emissions at or below the applicable interference threshold;

2 that administrations operating FSS or BSS satellites and systems, in carrying out their obligations under *resolves* 1 above, shall take into account only those RAS stations for which complete notification materials have been received by the BR as of the date on which complete coordination or notification materials (as appropriate) for the subject satellite network or system are received by the BR;

3 that, notwithstanding *resolves* 2 and taking into account *recognizing* d), administrations operating FSS or BSS satellites and systems, in carrying out their obligations under *resolves* 1 above, are urged to take into account later-notifying RAS stations to the extent reasonably practicable;

4 that the obligations on administrations under *resolves* 1 and 2 above shall apply to all FSS or BSS networks and systems for which complete coordination (GSO) or notification (non-GSO) has been received after June 3, 2000,

urges administrations

that plan FSS or BSS networks or systems in the 42-42.5 GHz band to take all reasonably practical steps, early in the design phase of implementation, to avoid exceeding the interference thresholds in No. **5.551G** at the site of a RAS station where single-dish radiotelescope observations are being conducted in the 42.5-43.5 GHz band,

invites ITU-R

to facilitate the ability of administrations to meet the obligations of *resolves* 1 above by identifying technical and operational measures in the band 42-42.5 GHz, including possible mitigation techniques, that administrations may implement to protect concerned radio astronomy stations operating in the bands referenced in No **5.551G**, as well as measures that may be implemented by single-dish radiotelescopes conducting continuum and spectral line observations in the same bands to reduce their susceptibility to harmful interference from satellite networks and systems,

instructs the Director, BR

to review, on the basis of this Resolution and the modification to No. **5.551G** made by this Conference, any findings made pursuant to No. **5.551G (WRC-2000)** and Resolution **128 (Rev. WRC-2000)** in the interval between the end of WRC-2000 and the end of WRC-03.

USA/1.32/C
SUP

~~RESOLUTION 128 (Rev.WRC-2000)~~

~~Protection of the radio astronomy service in the 42.5-43.5 GHz band~~

Reasons: Consequential to the conclusion that RAS is adequately protected if out-of-band emissions from FSS and BSS satellites in the 42-42.5 GHz band are limited in the manner proposed in No. **MOD5.551G** and Resolution **XXX** above.